tion of Civil Engineers, Mr. W. H. Preece, F.R.S., will give a review of the work done by the Electrical Congresses of Paris, and will describe the new units determined upon.

THE Lord Lieutenant of Ireland has appointed the following Commissioners to inquire into the management of the Queen's Colleges and Royal University in Ireland:—R. P. Carton, Q.C., Mr. George Johnstone Stoney, F.R.S., Rev. Dr. Gerald Molloy, Rector of the Catholic University, Mr. Wm. Jack of Glasgow University, and Surgeon-General Marsten. Mr. N. D. Murphy, barrister, is appointed secretary.

THE Engineering Department of the Yorkshire College at Leeds is about to be considerably enlarged, to admit of more students at the classes, and towards this object Sir Andrew Fairbairn, M.P., and Sir John Hawkshaw have each contributed 1000*l*.

THE steamer *Alert*, one of the vessels to be engaged in the Greely Relief Expedition, sailed from New York on May 10.

THE eminent Swedish astronomer, Prof. H. Gyldén, at present chief of the Stockholm Observatory, has been called to the Professorship of Practical Astronomy at Göttingen.

HERR AUGUSTIN GAMÉL of Copenhagen has offered to despatch the *Dijmphna*, under Lieut. Hovgaard, to Franz-Josef Land in the summer of 1885, provided the Danish Government will contribute part of the expenses. No contribution will be accepted from foreign nations.

PROF. NORDENSKJÖLD has executed a detailed map of that part of the east coast of Greenland which he visited last summer, situated beyond Cape Dan, known from Lieut. Graah's journey. The peninsula on which the cape is situated he has named "King Christian's Island," and the harbour in which he landed "King Oscar's Harbour." Several other points have been named after celebrated Swedes and Danes.

THE Finnish Senate has petitioned the Czar that all members of the forthcoming hydrographical expedition in the Baltic, which will cost about 100,000 marks, shall be Finnish subjects, as so little progress with such labours seems to be made under Russian naval officers.

THE St. Petersburg Horticultural Exhibition and Botanical Congress, which was deferred last year owing to the coronation of the Czar, was opened on May 5. Mr. H. J. Elwes, F.L.S., of Preston House, Cirencester, was requested by the Science and Art Department to attend as the delegate on behalf of this country, and has been accredited.

MR. J. E. MARR, M.A., Fellow of St. John's College, Cambridge, has been appointed by the Council to lecture in geology.

A VIOLENT shock of earthquake, having an undulatory character, was felt at Spoleto at 8 o'clock on Friday night. The bells were set ringing and the clocks stopped. On Saturday, at 9.50, a slight shock in the direction of from north-west to south-east was felt at Cosenza, and at Paola a somewhat stronger shock was felt.

THE additions to the Zoological Society's Gardens during the past week include a Barbary Ape (*Macacus inuus* ♀) from North Africa, presented by the Countess of Craven; a Moufflon (*Ovis musimon* ♂) from Sardinia, presented by Col. Knox and the Officers of the 1st Battalion Scots Guards; a Common Raccoon (*Procyon lotor*, white variety) from North America, presented by Mr. F. J. Thompson; a Ground Hornbill (*Buceros abyssinicus*) from West Africa, presented by Capt. Rupert La T. Lonsdale; a Gold Pheasant (*Thaumalea picta* ♀) from China, presented by Mr. Frank Reed; two Peregrine Falcons (*Falco peregrinus*), European, presented by Lieut.-Col. Drummond Moray; two Alligators (*Alligator mississippiensis*) from the Mississippi, presented by Mrs. Andrade; a Green Tree Frog (*Hyla arborea*), European, presented by Mr. G. W. Obicini, F.Z.S.; twenty-one River Lampreys (*Petromyzon fluviatilis*) from British rivers, presented by Mr. T. E. Gunn; two Japanese Greenfinches (*Ligurinus sinicus* ♂ ♀) from Japan, two Common Crowned Pigeons (*Goura coronata*) from New Guinea, purchased; a Canadian Porcupine (*Erithizon dorsatus*), five Long-fronted Gerbilles (*Gerbillus longifrons*), two Variegated Sheldrakes (*Tadorna variegata*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

THE APPROACHING RETURN OF OLBERS' COMET.—Now that the comet of Pons is drawing away from us, attention may be directed to another comet belonging to the same group as regards length of revolution, viz. that discovered by Olbers at Bremen on March 6, 1815, and last observed by Gauss at Göttingen on August 25. While it was still under observation an elliptic orbit was assigned by several astronomers, including Bessel and Gauss, who found the period between seventy and eighty years. Bessel subsequently discussed all the observations available to him, in a memoir published in the *Transactions of the Berlin Academy*, and, after determining the most probable orbit in 1815, he calculated the planetary perturbations to the time of ensuing return to perihelion, which he fixed to 1887, February 9, the effect of the perturbations being to accelerate the return by about 825 days.

An elaborate investigation of the elements of Olbers' comet and the effects of planetary attraction during the current revolution has been lately made by Herr F. K. Ginzel, of Vienna: it gained the prize of the Haarlem Society of Sciences, and was published by the Society in 1881. The author has availed himself of the improved values of the planetary masses and the other advantages which the astronomy of the last seventy years has placed in our hands, and has produced an interesting and skilfully-worked discussion of the motion of the comet since it passed out of view in 1815. He commences with a solar ephemeris, and coordinates X, Y, Z, founded upon Leverrier's Tables, and extending from March 4 to August 27, followed by an ephemeris from Bessel's ellipse of the comet's geocentric right ascension and declination and log. distance for the same period. In the next section the observations are as far as possible newly reduced, great care and trouble having been bestowed on the determination of the places of the comparison stars from the most reliable catalogues. It may be mentioned that there are observations at fourteen observatories, including Greenwich, where the comet was followed from May 22 to July 7; the series newly reduced are those of Berlin, Göttingen, Königsberg, Paris, Prague, and Seeberg. The necessary data for reduction of mean to apparent places of the comparison stars follow. The effect of parallax is applied to the comet's observed positions, and we have then the entire collection of deduced geocentric places, with the Berlin mean times of the observations.

In Bessel's investigation 187 observations were utilised; Ginzel has the greatly increased number of 346. The perturbations of Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune are next calculated for the period over which the observations extend; twelve normal positions are formed, and cleared of the effect of planetary attraction; then, in the usual manner, Bessel's elements are corrected by equations of condition, and the following definitive orbit for 1815 is obtained:—

Perihelion passage, 1815 April 26·030146 Berlin M.T.

Longitude of perihelion	149° 2′ 2″·8	M.Eq. 1815·0
,, ascending node	83 28 46·7	
Inclination	44 29 50·8	
Eccentricity	0·93114958	
Log. perihelion distance	0·0837998	

Hence there results a revolution of nearly 74 years. The limits of uncertainty in this period are then examined, and found to be 75·68 and 72·33 years, and thus Ginzel concludes that the time of revolution given by the complete discussion of the observations of 1815 is in doubt to the extent of 1·6 year, or about a year and seven months.

In the next section of the memoir are presented the details of the laborious work involved in the calculation of the effect of planetary attraction during the actual revolution. The separate effect of each of the planets Jupiter, Saturn, Uranus, and Neptune

is assigned, and as regards the period, will be found from Ginzel's numbers to be—

		days
For Jupiter	... ...	−799·16
Saturn	... ...	− 27·27
Uranus	... ...	− 7·53
Neptune	... ...	− 2·76

These figures show a total acceleration of 836·72 days, and hence the most probable epoch of the next perihelion passage is found to be 1886 December 16·9 G.M.T.

After remarks upon the physical observations made in 1815, and Bessel's observation of a nearly central occultation of a star by the comet on April 26, we have extensive sweeping ephemerides to facilitate the rediscovery at the approaching return; the places are given for every tenth degree of the sun's longitude, and of the true anomaly from −120° to +120°. In view of the uncertainty in the length of the comet's period, it may be well to commence the search in 1885.

In a supplement Ginzel examines the effect of the attraction of the smaller planets Mercury, Venus, the Earth, and Mars from March 1815 to February 1817; also the possible effect of a resisting medium: these are found to be too small to be worthy of consideration practically.

The elements assigned by Ginzel's investigation for the comet's next appearance are :—

Perihelion passage, 1886 December 16·9338 Berlin M.T.

Longitude of perihelion	149 48 40·3	M. Eq. 1887·0
,, ascending node... ...	84 31 24·2	
Inclination	44 33 34·3	
Angle of eccentricity	68 31 3·0	
Mean daily sidereal motion	49″·387785	
Log. semi-axis major	1·2375914	

To which corresponds a period of revolution of 71·843 years.

THE BUILDING OF THE ALPS [1]

II.

I PASS now to the section of the Simplon. On the southern side, deep in the glen of the Doveria, in the vicinity of the gorge of Gondo, we find a mass of granitoid gneiss, which recalls to mind that already described from the wildest portion of the upper valley of the Reuss. We may, I think, with confidence affirm that, whatever be the true nature of this rock, we are again touching the foundation-stones of the rock masses of the Alps. As we approach Algaby, the granitoid gneiss becomes more distinctly bedded and variable, a thin band of micaceous crystalline limestone is passed, and presently the more rapid ascent of the pass begins. Hence to beyond the summit we traverse, so far as can be seen, a great series of bedded gneisses, often coarse and even porphyritic, and of schists. The same are displayed in the crags of Monte Leone on the east and of the Rossbodenhorn on the west. As shown in Prof. Renevier's valuable section, bands of crystalline dolomitic limestone, and of hornblendic and garnetiferous schists occur in various places on either side of the Simplon road. Then, after descending about half way to Brieg, we strike the group of the Lustrous Schists, with the usual calcareous zone in the lower part. Prof. Renevier does not attempt to unravel the complexities of the strata which compose this portion of the central ridge of the Alps, and I feel that my slighter knowledge makes caution yet more imperative; but I think we are justified in asserting that we have evidence of an upward succession from the coarse granitoid fundamental gneisses, through more variable and bedded gneisses, to a group which recalls the garnetiferous schists, so finely developed on the southern flanks of the St. Gothard—a group also traceable in the upper portion of the Binnenthal, though apparently far less perfectly developed. I think also that in the gigantic anticlinal of the Simplon we have evidence of sharp flexures on a great scale; and that these garnetiferous schists are only here and there preserved as the lower ends of infolded loops, so that the bulk of the *massif*, and, so far as I can tell, the actual summit ridges of the Rossbodenhörner and Monte Leone, are composed of the bedded gneisses and strong schists, and perhaps of the more friable gneisses which have been already described in the mountains further to the east.

The mountains further west—the aspiring peaks which rise around the two branches of the Visp, including among them some of the highest summits of the Alps, such as Monte Rosa, the Mischabelhörner, the Matterhorn, and the Weisshorn—offer indeed magnificent sections, but are full of difficulty. The fundamental gneiss, if I mistake not, is occasionally exposed—as, for example, in the rocks of Auf der Platte, at the base of Monte Rosa; and in parts of the Mischabelhörner blocks of coarse granitoid rock, often very porphyritic, which I refer to the same series, are brought down by the glaciers. There are also mica schists in plenty, such as the summit rocks of Monte Rosa and the backbone—if the phrase be permitted—of the Mischabel- and Saaser-hörner, which I refer to the second zone already described—that of the bedded gneisses and strong mica schists. I have also seen specimens which closely resemble the garnetiferous schists of the St. Gothard district, but we meet in this district with a group of rocks which, if not altogether unknown before, appear now to be developed to an exceptional extent, and to become an important factor in the Alpine crystalline series.

Those who are familiar with the environs of Saas and Zermatt will remember how frequently schists or schistose rocks of a greenish colour occur. Sometimes they are interbedded with strong mica schists, or schisty quartzites, sometimes they form homogeneous masses of considerable extent. It is possible that some of the latter are intrusive masses of serpentine, to which subsequent pressure has given a schistose aspect; certainly there are occasional masses of coarse gabbro, which I think undoubtedly an intrusive igneous rock; but still, making all allowance for such cases, there is in this region a considerable mass of greenish hornblendic, talcose, and serpentinous rocks which appears to be non-igneous in origin. We find these all around Zermatt. They form the ridges of the Gorner Grat and of the Hornli. They break out through the snows of the Breithorn and Little Mont Cervin, and constitute no inconsiderable portion of the mighty obelisk of the Matterhorn. The whole of that peak, according to the investigations of Sgr. Giordano—and with this my own recollections correspond—consists of an apparently regularly bedded series of serpentinous and micaceous schists, and of greenish gneisses, with the exception of a gabbro, developed on the western side, which I have no doubt is an intrusive rock. Can we trust these indications? Are we justified in assigning to this zone, with those characteristics, a vertical thickness of more than a mile? To these questions I can give at present no answer, further than to state that I am convinced that, notwithstanding the apparent regularity of the bedding in this and the neighbouring peaks, there are really great folds which patient scrutiny may at length unravel, and that this zone of greenish rocks—for which Alpine geologists have proposed the name of *Pietra Verde* group, appears to underlie the garnetiferous series of silvery mica schists, and either to overlie or replace the upper portions of the banded gneiss series which succeeds to the fundamental series.

I do not propose to weary you further with the details of Alpine sections, except that I must add a few words upon the extent of this remarkable series to which I have now introduced you. On the northern side of the watershed in the Swiss Alps, so far as I am aware, it is not generally strongly developed, except in certain localities in the southernmost of the three ranges which make up the whole chain, but in parts of the Tyrol it is well displayed. It borders—the mica schists sometimes dominating—the fundamental gneiss in the Oetzthal *massif;* it forms the peak of the Gross Glockner; it meets us on the Brenner Pass and elsewhere overlain by and folded up with rocks which, if my memory do not mislead me, are the equivalents of the Lustrous Schists of more western districts.

Again, it is finely developed, seemingly in succession to bedded coarser gneiss, in some of the peaks of the Bernina range, and it occupies a considerable tract about the heads of the valleys to the south. It may be traced, indeed, over a great zone, and with but slight interruption all along the southern slopes of the Alps, even to the south of the head waters of the Po, forming many of the grandest peaks in the Graian, Tarentaise, Maurienne, and Cottian Alps; and we find traces of it overlying the coarse granitoid series in the *massif* of the Alps of Dauphiné.

Sections, indeed, in the neighbourhood of Biella, according to Gastaldi and Sterry Hunt, exhibit the Pietra Verde group overlying the upper or more bedded portion of the great gneissic or basal series, and succeeded by the group of friable gneisses, described above as closely associated with the garnetiferous schists, in a manner that suggests an unconformity. Under ordinary circumstances we should not hesitate to admit

[1] Lecture by Prof. T. G. Bonney, D.Sc., F.R.S., Pres.G.S., at the Royal Institution, April 4. Continued from p. 46.